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RESEARCH ARTICLE

Cost Savings from Assertive Community Treatment Services in an Era of Declining Psychiatric Inpatient Use

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Objective. To assess, during a period of decreasing psychiatric inpatient utilization, cost savings from Assertive Community Treatment (ACT) programs for individuals with severe mental illnesses.

Data Source. U.S. Department of Veterans Affairs' (VA) national administrative data for entrants into ACT programs.

Study Design. An observational study of the effects of ACT enrollment on mental health inpatient utilization and costs in the first 12 months following enrollment. ACT enrollees ($N = 2010$) were propensity score matched to ACT-eligible non-enrollees ($N = 4020$). An instrumental variables generalized linear regression approach was used to estimate enrollment effects.

Results. Instrumental variables estimates indicate that between FY2001 and FY2004, entry into ACT resulted in a net increase of $4529 in VA costs. Trends in inpatient use among ACT program entrants suggest this effect remained stable after FY2004. However, eligibility for ACT declined 37 percent, because fewer patients met an eligibility standard based on high prior psychiatric inpatient use.

Conclusions. Savings from ACT programs depend on new enrollees' intensity of psychiatric inpatient utilization prior to entering the ACT program. Although a program eligibility standard based on prior psychiatric inpatient use helped to sustain the savings from VA ACT programs, over time, it also resulted in an unintended narrowing of program eligibility.

Key Words. Assertive community treatment, inpatient use, serious mental illness

Assertive Community Treatment (ACT) is a mobile team-based outpatient service model for providing comprehensive psychiatric care and case management supports to persons with serious mental illnesses. Clients suitable for ACT services are severely ill and intensively use inpatient psychiatric care. For these individuals traditional outpatient services may not be adequate to prevent the need for acute care (Stein and Test 1980; Phillips et al. 2001). It has become accepted wisdom that ACT programs are cost-neutral or cost-saving (Phillips et al. 2001), a perception that may be based on dramatic reductions of psychiatric inpatient use in early experiments with ACT during the late 1970s and early 1980s (Weisbrod, Test, and Stein 1980), an era when lengthy psychiatric inpatient stays were still prevalent (Manderscheid et al. 1985). However, this perception could be outdated because of the dramatic reductions in inpatient mental health use by the population of disabled persons with serious mental illness in most state public mental health systems and the U.S. Department of Veterans Affairs (VA) health care system (Witkin, Atay, and Manderscheid 1996; Sturm and Bao 2000; Zuvekas 2001; Greenberg and Rosenheck 2010). Using data from the VA health care system, this study estimates the effects of ACT services on VA costs and inpatient mental health services utilization, examining whether cost savings from ACT were affected by a decline in VA inpatient mental health utilization.

The ACT is considered one of the most effective approaches for delivering services to people with severe and persistent mental illness (Rosenheck and Neale 1998a, b; Latimer 1999; Phillips et al. 2001). ACT brings together essential services and staff members from different disciplines in order to support clients in the community rather than in inpatient settings (Bond et al. 2001). The ACT model requires a clinician team leader, normally a social worker or psychologist, as well as one or more nurses, a psychiatrist, and a substance abuse specialist (Teague, Bond, and Drake 1998). Teams maintain a low client–staff ratio (the model-specified maximum ratio is 12 : 1) and accept complete responsibility for the care of clients (Stein and Test 1980). Services are available 24 hours a day, 7 days a week, and care is fully mobile. In 2010, more than 65,000 persons with serious mental illness were enrolled in more than 800 ACT programs in 38 U.S. states and in the VA health care system (NASMHPD Research Institute, I. 2009; Neale et al. 2009). ACT services can

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cost from $6,000 to more than $12,000 per client annually (Latimer 1999), and clients may continue receiving ACT services indefinitely.

Since the early 1980s, several evaluations have demonstrated that, despite ACT's substantial up-front costs, enrollment in an ACT program can result in lower overall mental health costs, primarily because ACT clients use less inpatient mental health care (Weisbrod, Test, and Stein 1980; Latimer 1999; Phillips et al. 2001). This body of evidence supported rapid dissemination of ACT programs into public mental health systems during the 1980s and 1990s (Richardson 1999; Veterans Health Administration 2004). Although ACT services can be cost-neutral, evidence suggested that the cost neutrality of ACT depends critically on whether programs select clients whose number of inpatient bed days immediately prior to ACT entry is sufficiently high (Rosenheck, Neale, and Frisman 1995; Rosenheck et al. 1995). This evidence influenced the VA's decision to limit entry into ACT services to patients with "high hospital use," defined as having more than 30 inpatient mental health bed days or at least 3 inpatient mental health admissions in the previous 12 months (Veterans Health Administration 2004).

The mediating impact of ACT program entrants' prior inpatient mental health use on the cost consequences of ACT may have become more salient over time as a result of the dramatic declines in use of inpatient care by persons with severe and persistent mental illness (Witkin, Atay, and Manderscheid 1996; Sturm and Bao 2000; Zuvekas 2001; Greenberg and Rosenheck 2010). These changes were driven by various factors, including widespread dissatisfaction with institutional care in state psychiatric hospitals (Geller 2000a) and states' increased use of Medicaid as a source of financing for inpatient mental health care (Geller 2000b); Medicaid generally excludes coverage for non-elderly adults' stays in "institutions for mental diseases" (Geller 2000b). As a result of these declines, ACT-related cost savings from reduced inpatient use as well as the number of potential ACT clients for whom ACT services would be cost-saving would be expected to decline. Such changes may have critical implications for public financing of ACT services and other ACT-like intensive case management models. Meanwhile, evidence on the impacts of ACT on costs and inpatient use is almost entirely based on data from experimental ACT programs rather than on "real-world" ACT programs deployed into public mental health systems. The effectiveness of ACT services could be more variable in practice than has been shown in experimental settings, because real-world ACT programs both in the VA and elsewhere do not have uniform fidelity to the ACT model (Salyers et al. 2003).

Data from all VA ACT programs in fiscal years 2001–2004 (FY01–FY04) were used to examine the impacts of entry into an ACT program on newly enrolled clients' inpatient utilization and mental health costs during the first 12 months of enrollment. We examined both the average program impact and differential (i.e., marginal) program impacts for clients with greater versus fewer inpatient bed days before program entry. VA ACT clients' mental health services utilization and health care costs were compared with the services utilization and costs of a similar group of VA patients who met administrative eligibility criteria for VA ACT services during the same time period but did not enroll in ACT. To address selection bias, we combined two analytic approaches, propensity score matching (Rosenbaum and Rubin 1983; Ho et al. 2007) and instrumental variables estimation (Angrist, Imbens, and Rubin 1996; Heckman 1996; Hogan and Lancaster 2004). While propensity score matching resulted in a comparison group that was similar to ACT enrollees in terms of measured characteristics, the instrumental variables method was needed to address selection bias due to unmeasured confounders. The study's instrumental variables were based on variations in VA patients' access to ACT services during fiscal years 2001–2004, a period of rapid dissemination of new VA ACT programs.

METHODS

Empirical Model

On the basis of prior literature (Rosenheck et al. 1995), we hypothesized that VA ACT services would reduce new clients' use of inpatient mental health services compared with the reference group and that these effects would be greater in absolute magnitude for those ACT clients who had more inpatient mental health bed days during the 12-month period before program entry. Although we did not hypothesize either a positive or negative impact on net mental health costs, we expected that the cost-offsets (i.e., gross savings) resulting from enrollment in ACT would be greater among clients who had more inpatient mental health bed days in the 12 months immediately preceding program entry. The following empirical model for mental health inpatient use and costs was specified:

$$E[y_i|m_i, \mathbf{x}_i, z_i] = F[b_0 + \mathbf{b}_1'\mathbf{x}_i + b_2 z_i + \delta_1 m_i + \delta_2 m_i(z_i - \mu)] \qquad (1)$$

where E is the expected value function; y is a dependent variable (mental health costs or inpatient mental health use); subscript i is an index of patients;

m is a binary indicator of whether the patient enrolled in ACT; $\mathbf{x}$ is a vector of patient characteristics that may be correlated with illness severity and service needs, health care access, and propensity for using health care services (Aday and Andersen 1974; Andersen 1995; Gelberg, Andersen, and Leake 2000); z is inpatient mental health bed days in the 12 months prior to ACT enrollment; F is a nonlinear function; b_0–b_3, δ_1, and δ_2 are parameters to be estimated; and μ is the mean of z. In Equation 1, $\delta_1<0$ represents the hypothesis that entry into ACT reduces mental health care inpatient utilization during the first 12 months of enrollment, and $\delta_2<0$ represents the hypothesis that the impacts of ACT entry on inpatient use and total mental health costs are greater in absolute magnitude when patients enter ACT with a greater number of inpatient mental health bed days in the 12 months before program entry.

Estimation Approach

The empirical model in Equation 1 was estimated using an instrumental variables generalized linear model (IV-GLM) estimation approach (Breslow and Clayton 1993; McCullagh and Nelder 1999) applied to propensity score-matched data. First, ACT enrollees (N = 2,010) were propensity score-matched one-to-two with ACT-eligible non-enrollees (N = 4,020). We adjusted for between-group mean differences in clinical diagnoses, utilization of inpatient services before program entry, VA priority status, demographic characteristics, and a time trend to control for time-related cohort effects and other changes in VA health care delivery. Balance was assessed using Hotelling's t-squared test of the equality of group means for all covariates (Hotelling 1931) and using t-tests of mean differences for individual covariates.

Although propensity score matching adjusts for group differences in measured confounders, it in general does not adjust for unmeasured confounders. Consequently, after propensity score matching the groups, we completed instrumental variables (IV) analyses (Angrist, Imbens, and Rubin 1996; Heckman 1996; Angrist and Krueger 2001; Hogan and Lancaster 2004). We used a specific IV approach developed by Wooldridge (Wooldridge 2003, 2008) for models with heterogeneous program effects. The instruments were distance from the patient's residence to the nearest VA ACT team and whether a VA ACT team was located at the VA hospital of the patient's most recent inpatient mental health stay. The distance measure varied by study index year and by the patient's zip code. The presence or absence of VA ACT teams varied by VA hospital and study index year. Conceptually, these instruments are valid if VA ACT program locations are not correlated with unmeasured factors that are systematically related to mental health inpatient utilization or costs. Although VA ACT programs were not randomly assigned to sites—ACT programs were formed by VA hospitals on a voluntary basis (Rosenheck and Neale 1998a, b)—in the VA health care system innovative mental health practices tend to disseminate geographically outward from the location where the practice was first used (Harpaz-Rotem and Rosenheck 2009). VA hospitals that implemented programs earlier consequently may have been more familiar with the ACT model because of their geographic proximity to universities and VA hospitals where clinical research on ACT services had taken place. The presence of weak instruments was tested using the Cragg-Donald *F*-statistic (Cragg and Donald 1993; Stock and Yogo 2005; Baum, Schaffer, and Stillman 2007), and the exclusions of the instruments from Equation 1 were tested using the Sargan-Hansen J-test (Baum, Schaffer, and Stillman 2007). To further minimize possible confounder bias resulting from unobserved regional differences in VA health care system access and veteran population health care needs, IV models included binary indicators (i.e., fixed effects) for 21 of the 22 Veterans Integrated Service Networks (VISNs), which are the regional administrative divisions of the VA health care system.

Compared with ordinary least squares, the generalized linear model (GLM) approach (Breslow and Clayton 1993; McCullagh and Nelder 1999) can better approximate distributions that are right-skewed, such as health care expenditures and service counts distributions, and is more robust to heteroskedasticity (Manning and Mullahy 2001). We examined three primary outcomes during the 12-month study follow-up period: (1) any use of acute inpatient mental health services, (2) number of bed days of acute inpatient mental health services, and (3) total costs for all VA mental health services (outpatient and inpatient). The probability of any inpatient mental health stay was specified using the normally distributed probability model (probit). The number of inpatient mental health days was specified as a negative binomially distributed outcome with a log link; unlike the Poisson distribution, the negative binomial distribution allows for overdispersion in the dependent variable (Hilbe 2007). Mental health costs were specified as a gamma distributed outcome with a log link. IV estimation was implemented using the two-stage residual inclusion approach (Terza, Bradford, and Dismuke 2008), which is appropriate for the GLM approach.

In bivariate analyses, we also examined several secondary outcome measures of use and costs of other services. Specifically, these were use of outpatient specialty mental health clinic services other than ACT (e.g., medication management, individual and group psychotherapy, substance abuse counseling, psychological testing, and other types of counseling), partial hospital services, and residential rehabilitation treatment services, as well as the costs of care for these service categories. Partial hospital programs are intensive outpatient mental health treatment programs, and VA residential rehabilitation treatment programs are short-term housing programs that provide intensive mental health and substance abuse treatment services and other types of counseling. Both are resource-intensive services primarily for VA patients with serious mental illness.

DATA

Sample

The VA's ACT program enrollment registry was used to identify all 3,076 new clients who entered ACT programs during fiscal years 2001–2004 (FY01–FY04), the first 4 years of the VA's ACT program. Eight-hundred-thirteen ACT clients were excluded from the study sample because VA records of their past use of inpatient mental health services indicated that they did not meet a national VA administrative "high hospital use" standard for entering ACT services—having at least 3 inpatient mental health admissions or more than 30 days of inpatient mental health care during the 12 months prior to entering ACT services—and consequently may not be comparable to other ACT clients. Of the remaining 2,263 clients, 130 did not have an International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code listed in the clinical record for either schizophrenia or bipolar disorder. Clients with only other admission diagnoses, such as major depression and posttraumatic stress disorder, may not be comparable to clients with acute psychotic disorders in relation to the impacts of the ACT program on costs or inpatient utilization. Of the remaining 2,133 clients, 31 who resided outside the usual catchment area for VA ACT programs (i.e., more than 60 miles away from a VA hospital) in the year of admission and 92 clients who died during the 12-month study follow-up period (i.e., the 12-month period immediately following enrollment in ACT) were excluded, leaving a final sample of 2,010 new ACT clients. Information on these clients' VA services utilization and health care costs during the study follow-up period and during the 12-month period immediately preceding enrollment in ACT were included in the study database.

To form a comparison group, we used data from the VA National Psychosis Registry to identify all 25,930 VA patients who met study inclusion criteria sometime during the FY01–FY04 period but were not enrolled in VA ACT services. All of these VA ACT-eligible non-enrollees had schizophrenia or bipolar disorder diagnoses, lived within 60 miles of a VA hospital, and met VA criteria for high mental health inpatient use sometime during the FY01–FY04 period. For each of these 25,930 patients, we randomly selected a study period start date from among all dates of eligibility for ACT in the FY01–FY04 period. The study follow-up period was then defined as the 12-month period immediately following the study period start date. Of the 25,930 patients, we excluded 2,781 patients who died during the study follow-up period and an additional 2,252 patients who never used any VA outpatient mental health service during the study follow-up period, leaving a final comparison sample of 20,897. This study was classified as exempt from human subjects review by Institutional Review Boards at the University of Maryland, and U.S. Department of Veterans Affairs and the U.S. Department of Veterans Affairs.

VA ACT Program Locations

By FY04 VA ACT programs were in all regions of the VA health care system and in 76 of 153 VA hospitals. A disproportionate number of these programs were located in the Northeast and the upper Midwest. The clustering may be a corollary of the fact that much of the early research, development, and evaluation of the ACT model occurred at university-affiliated teaching hospitals and VA hospitals located in cities in the Northeast and upper Midwest (Stein and Test 1980; Rosenheck et al. 1995; Rosenheck and Neale 1998a,b; Teague, Bond, and Drake 1998; Bond et al. 2001). In FY99, the year prior to the introduction of national VA ACT program guidelines in FY00, ACT-hospitals had more unique psychiatric inpatients per hospital-year (393 inpatients in ACT-hospitals and 274 inpatients in non-ACT hospitals, $p < .01$) and greater average length of stay (18.5 days in ACT-hospitals versus 11.5 days in non-ACT hospitals, $p < .01$). These differences suggest that ACT hospitals had more beds and tended to serve a more complex patient population. These and other unmeasured differences between ACT hospitals and non-ACT hospitals could have resulted in either an upward or downward bias to estimates of ACT's impacts. To examine these potential biases, a sensitivity analysis was conducted using data only from patients who lived near (i.e., within 60 miles of) an ACT hospital.

Sources

Measures of ACT enrollees' and ACT-eligible non-enrollees' utilization of inpatient and outpatient mental health services, diagnoses, and other characteristics were drawn from the VA's National Psychosis Registry, a national longitudinal VA patient registry on clients with serious mental illness that incorporates data from VA outpatient encounter and inpatient admissions records as well as multiple other VA administrative databases (Blow et al. 2004). Average costs associated with VA outpatient encounters and inpatient admissions were drawn from the VA Health Economics Resource Center (HERC) Average Cost database (Barnett 2003; Chen et al. 2003); psychiatric medication expenditures were not included in these cost estimates. These costs estimates are developed by allocating aggregate VA direct service delivery costs and overhead expenses across all outpatient encounters and inpatient admissions. Unit costs for each service are derived from the Medicare provider fee schedules and inpatient prospective payment systems, but they are scaled to reflect VA accounting cost totals.

Covariates

Analyses were adjusted for individual characteristics that may represent predisposing, enabling, and need factors in the Aday and Andersen framework (Aday and Andersen 1974; Andersen 1995; Gelberg, Andersen, and Leake 2000). Predisposing characteristics included client age and gender and presence of a substance use disorder diagnosis. Among people with serious mental illness, being older and male and having a substance use diagnosis are all associated with greater use of mental health care (Goldstein and Tsuang 1990; Dickey and Azeni 1996; Bartels et al. 2003). Enabling factors included whether the client had a VA service-connected disability rating ≥ 50 percent, which is an indicator of service priority status, and straight-line distance to the nearest VA hospital (McCarthy et al. 2007). Indicators of greater need for psychiatric care and higher costs included diagnosis of schizophrenia (compared with bipolar disorder) (Bartels et al. 2003); an indicator of any homelessness during the 12 months prior to the study start date (McCarthy et al. 2007); Charlson comorbidity index score, which is an index of somatic diagnoses that are predictive of mortality (Deyo, Cherkin, and Ciol 1992); residential rehabilitation treatment days and partial hospital days during the 12 months prior to the study start date; and whether there were any inpatient mental health bed days during the 30 days prior to the study start date. Homelessness in the 12 months prior to the study start date was evaluated based on VA encounter data (McCarthy 2002; Blow et al. 2004). Finally, analyses were adjusted for each observation's study index year, to account for secular time trends in VA mental health service delivery and health care costs.

RESULTS

Propensity Score Matching Estimates

Table 1 shows the characteristics of ACT enrollees and ACT-eligible non-enrollees before and after propensity score matching, and Table 2 shows comparisons of the two study groups on all study outcomes during the first 12 months after the study index date, using propensity score matched data. The proportion of ACT enrollees admitted to inpatient mental health care (61.9 percent) did not differ significantly from the percentage of non-enrollees admitted (62.5 percent of non-enrollees; $F = .2$, $p = .639$). However, compared with non-enrollees, proportionally fewer ACT enrollees used residential rehabilitation treatment program services (9.0 percent versus 12.2 percent of non-enrollees; $F = 14.8$, $p < .001$) and (non-ACT) outpatient specialty mental health clinic services (82.6 percent versus 95.6 percent for non-enrollees; $F = 240.7$, $p < .001$), and a greater proportion of ACT enrollees used partial hospitalization services (29.9 percent versus 19.6 percent for non-enrollees; $F = 73.9$, $p < .001$). ACT enrollees also had significantly fewer days of use of inpatient mental health, residential treatment, partial hospital, and outpatient specialty clinic services compared with non-enrollees ($p < .05$). In relation to mental health costs, ACT enrollees' total mental health costs exceeded non-enrollees' costs by $1,361 ($28,881 versus $27,520 for non-enrollees; $F = 4.3$, $p = .038$), a difference of approximately 5 percent. Although ACT services cost $6946 per enrollee, ACT enrollees had lower costs for inpatient mental health care ($F = 21.0$, $p < .001$) and mental health residential rehabilitation treatment ($F = 46.9$, $p < .001$). Their inpatient costs were lower by $4,543 (21 percent), and their residential treatment costs were lower by $978 (62 percent). Differences in costs for other (non-ACT) outpatient services were proportionally smaller and not statistically significant at the $p < .05$ level.

Instrumental Variables Estimates

In contrast to the mean comparisons using propensity score-matched data (shown in Table 2), the instrumental variables estimates (Table 3) indicate

Table 1: Characteristics of the Sample before and after Propensity Score Matching

	Unmatched Sample				Matched Sample			
	No ACT (N = 20,897)	ACT (N = 2010)	F	p	No ACT (N = 4020)	ACT (N = 2010)	F	p
Male (%)	92.0	90.4*	5.6	.018	90.5	90.4	<0.1	.853
Age in years	50.3	50.1*	12.1	.001	51.3	50.1	0.7	.394
Any inpatient mental health bed days, past 30 days (%)	45.8	67.2*	378.2	<.001	66.3	67.2	0.5	.462
Number of inpatient mental health bed days, past 12 months	44.8	68.2*	253.1	<.001	67.4	68.2	0.3	.617
Partial hospital days past 12 months	3.8	9.8*	82.9	<.001	10.4	9.8	0.4	.535
Residential rehabilitation treatment days past 12 months	14.4	11.6*	7.8	.005	12.6	11.6	0.7	.418
Schizophrenia diagnosis (%)	60.7	80.3*	425.1	<.001	80.3	80.3	<0.1	.982
Homeless past 12 months	38.9	26.4*	145.0	<.001	26.2	26.4	<0.1	.885
% with SCDR > 50 (%)	49.0	54.9*	25.9	<.001	55.7	54.9	0.4	.546
Substance use diagnosis (%)	61.4	46.8*	158.5	<.001	44.6	46.8	2.6	.108
Charlson comorbidity index × 100	64.1	63.9	<0.1	0.947	66.2	63.9	0.9	.344
Study index fiscal year (%)								
FY01	30.5	11.2*	623.4	<.001	11.1	11.2	<.1	.977
FY02	23.0	27.2*	16.4	<.001	25.9	27.2	1.3	.258
FY03	20.8	30.4*	81.9	<.001	31.3	30.4	0.5	.490
FY04	25.7	31.2*	25.7	<.001	31.7	31.2	0.2	.680
Hotelling F-test of equal group means			116.2	<.001			.57	.916

*Differs from No ACT at $p < .05$.
SCDR, service connected disability rating.

Table 2: Mental Health Services Use and Costs during the First 12 Months after the Study Index Date (Matched Sample, $N = 6{,}030$)

	No ACT Mean (SD)	*ACT Mean (SD)*	*F*	*p*
% w/any service use				
Inpatient (acute)	62.5 (.8)	61.9 (1.1)	0.2	.639
Residential rehabilitation	12.2 (.5)	9.0* (.6)	14.8	<.001
Other outpatient				
Partial hospital	19.6 (.6)	29.9* (1.0)	73.9	<.001
Outpatient specialty clinic	96.5 (.3)	82.6* (.8)	240.7	<.001
Days†				
Inpatient (acute)	45.0 (1.2)	36.4* (1.5)	20.6	<.001
Residential rehabilitation	100.0 (4.8)	42.3* (4.0)	84.6	<.001
ACT	—	67.9* (.9)	5,503.8	<.001
Other outpatient (except ACT)				
Partial hospital	53.3 (2.3)	41.3* (2.2)	14.2	<.001
Outpatient specialty clinic	19.2 (.5)	17.6* (.6)	5.1	.024
Costs ($)				
Total mental health	27,520 (670)	28,881* (755)	4.3	.038
Inpatient (acute)	21,633 (649)	17,090* (750)	21.0	<.001
Residential rehabilitation	1,572 (114)	594* (86)	46.9	<.001
ACT	—	6,946* (137)	2,305.4	<.001
Other outpatient (except ACT)	4,315 (4316)	4,251 (164)	0.1	.773
Partial hospital	1,180 (76)	1,230 (111)	0.14	.710
Outpatient specialty clinic	3,135 (126)	3,020 (113)	0.46	.496

Notes. The propensity score matched sample included 2,010 ACT enrollees and 4,020 ACT eligible non-enrollees.
*Different from No ACT at $p < .05$.
†Among persons with any use of services in category.

substantially larger impacts of ACT enrollment on mental health inpatient days. On average, enrollment in ACT resulted in 65.7 percent fewer inpatient mental health bed days ($z = -2.04$, $p = .041$) but did not significantly impact the probability of an inpatient mental health admission ($\beta = -.288$, $z = -.79$, $p = .429$). Despite these larger impacts on inpatient use, total mental health costs were not significantly significant reduced ($\beta = -.133$, $z = -.33$, $p = .742$). Coefficient estimates for the interaction between ACT enrollment and inpatient mental health bed days during the 12 months before ACT program entry (shown in the bottom panel of Table 3) were negative and statistically significant for the probability of an inpatient admission ($z = -3.35$, $p = .001$), the number of inpatient mental health bed days ($z = -2.56$, $p = .011$), and total mental health costs ($z = -2.32$, $p = .001$).

Table 3: IV-GLM Estimated Impacts of Enrollment in ACT on Inpatient Mental Health Use and Total Mental Health Costs, First 12 Months Post Enrollment (matched sample, $N = 6{,}030$)

	β	z	p	*95% CI*	*Marginal Effect (%)*	*Cragg-Donald Wald Test F [p-value]*	*Sargan-Hansen J Test X^2 [p-value]*
Main effects (δ_1)							
Pr(Inpatient admission)	−.159	−.70	.487	(−.608, .290)	−6.1	63.2 [<.05]	4.32 [.228]
Inpatient mental health bed days†	−.577**	−2.78	.005	(−.984, −.170)	−57.7	62.6 [<.05]	3.16 [.676]
Total mental health costs ($)	.221	1.03	.303	(−.200, .642)	22.1	62.6 [<.05]	2.57 [.766]
Interactions with prior inpatient MH bed days (δ_2)							
Pr(Inpatient admission)	−.005**	−2.69	.007	(−.009, −.001)	−.2		
Inpatient mental health bed days†	−.007**	−3.82	<.001	(−.011, −.003)	−.7		
Total mental health costs ($)	−.008**	−4.33	<.001	(−.012, −.005)	−.8		

*$p < .05$;
**$p < .01$.
†Among persons with some use of services in category.

Sensitivity Analyses

Two sensitivity analyses were completed to assess whether the study's results are sensitive to unmeasured features of VA mental health care that are correlated with living near a VA hospital with an ACT program. First, the sample was limited to patients who were living within 60 miles of a VA hospital with an ACT program. Using this sample, the instrumental variable analyses proved infeasible. None of the instruments was significantly correlated with patient enrollment in a VA ACT program. This is not surprising, because distance to an ACT program was constrained to be similar for ACT enrollees and non-enrollees. However, the results of the propensity score analyses were nearly identical to the results for the full sample (see Table 2). Mean mental health inpatient days were 36.1 for ACT enrollees and 52.4 days for non-enrollees ($p < .001$). Total mental health costs were \$28,033 for ACT enrollees and \$28,261 for non-enrollees ($p = .841$). Second, analyses were stratified by index year (FY01–FY04). The instrumental variables estimates were unstable across years with respect to the direction and magnitude of effects on mental health inpatient bed days and total costs, perhaps because of the smaller sample size. Propensity score estimates were more stable. Entry into ACT was associated with 11.2 fewer inpatient bed days in FY03 ($p < .001$) and 16.4 fewer bed days in FY04 ($p < .001$). In FY01 and FY02, ACT entry was nominally but not significantly associated with fewer inpatient bed days. For estimates of total VA mental health costs, there was no apparent pattern over time. ACT entrants had greater costs than non-entrants in FY02 (\$31,156 versus \$22,724 for non-entrants, $p < .001$) and lower costs than non-entrants in FY04 (\$27,401 versus \$31,592 for non-entrants, $p = .027$). In FY01 and FY03, there was no significant difference in costs.

Projected Costs and Inpatient Use

Using predicted values from the regression model estimates in Table 3, the marginal impacts of ACT enrollment on mental health inpatient use and mental health costs during clients' first 12 months in a VA ACT program were estimated, holding constant all covariates except for mental health inpatient bed days during the 12 months preceding enrollment. On average, clients entering VA ACT programs from FY01 to FY04 had 68.3 mental health inpatient bed days in the 12 months prior to program entry. The regression estimates imply that for these clients, entry into ACT resulted in a net increase of $4,529 in VA mental health costs and 15.6 fewer mental health inpatient bed days during the first 12 months of enrollment. Based on these same estimates, a point of cost neutrality is reached when VA ACT clients enter an ACT program with 95 mental health inpatient bed days in the 12 months prior to program entry.

Table 4 shows the average number of mental health inpatient bed days in the 12 months prior to VA ACT program entry for all VA ACT enrollees from FY01 to FY10. ACT program entrants' average inpatient mental health bed days during the 12 months before program entry declined 39.7 percent between FY01 and FY05, from 99.1 bed days to 59.8 bed days, then remained stationary through FY10. As a result, the savings achieved by ACT during the first 12 months following program entry may have declined after FY01. After FY01, mean mental health inpatient bed days during the 12 months prior to VA ACT program entry remained <95—the break-even point—suggesting that after FY01 new entrants into VA ACT programs had greater average mental health costs than if they had not entered ACT. Meanwhile, Table 5 shows that the number of VA patients with schizophrenia or bipolar disorder diagnoses who met the high hospital use threshold has decreased over time, from 11,867 in FY01 to 7,493 in FY10, a decline of 37 percent, even while the number of VA patients with schizophrenia or bipolar disorder diagnoses increased. As a result, the proportion of VA patients with schizophrenia or bipolar disorder diagnoses who met basic administrative eligibility criteria for ACT services declined from 7.2 percent in FY01 to 3.9 percent in FY10.

Table 4: Inpatient Mental Health Bed Days in the 12 Months before VA ACT Program Entry, FY01–FY10

Fiscal Year of Program Entry	*Mean Days*	*% Change from FY 2001*
2001	99.1	
2002	92.1	−7.1
2003	71.7	−27.6
2004	65.7	−33.7
2005	59.8	−39.7
2006	64.6	−34.8
2007	60.0	−39.5
2008	60.1	−39.4
2009	61.3	−38.1
2010	61.8	−37.6

Source: VA National Psychosis Registry, SMITREC.

Table 5: Eligibility for VA ACT Services, FY01–FY10

Fiscal Year	*VA Patients with Schizophrenia or Bipolar Disorder Diagnoses...*	*...and with "High Hospital Use" in the Last 12 Months*	
	N	*N*	*%*
2001	164,287	11,867	7.2
2002	164,295	11,052	6.7
2003	166,220	10,051	6.0
2004	168,359	9,432	5.6
2005	171,289	9,148	5.3
2006	173,637	8,746	5.0
2007	175,126	8,277	4.7
2008	179,818	8,038	4.5
2009	186,875	7,685	4.1
2010	193,922	7,493	3.9

DISCUSSION

This study examined the mental health savings resulting from VA ACT clients' first 12 months of ACT enrollment during an era of declining mental health inpatient use. We calculated that VA ACT services are cost-saving for patients with more than 95 mental health inpatient bed days in the 12 months prior to entering ACT and cost-increasing for patients with fewer than 95 bed days. Between FY01 and FY04, new VA ACT clients had just over 68 bed days on average, and their entry into ACT was estimated to result in a $4,529 increase in VA mental health costs. Between FY01 and FY05 ACT program entrants' average inpatient mental health bed days before program entry declined nearly 40 percent, then remained essentially constant through FY10. Thus, by targeting enrollment to patients with high psychiatric inpatient use prior to ACT program entry, the VA's "high hospital use" program entry criterion (i.e., at least 31 mental health inpatient bed days or 3 inpatient admissions in the prior 12 months) may have helped to limit the net budgetary impact of the VA's ACT program despite the secular decline in VA inpatient mental health use.

However, the high hospital use criterion may impose a tradeoff between program cost-effectiveness and program access. Fewer persons are attaining the high hospital use threshold as inpatient use falls (Table 5). This winnowing of the target population suggests the need to reconsider the administrative rule for targeting ACT services. Although modification to allow greater access may increase net program costs, maintaining strict adherence to the rule may limit the reach and patient-level benefits of an evidence-based program.

Similar tradeoffs between cost-effectiveness and access may be occurring with other resource intensive and cost-effective health care programs, such as the Program of All-Inclusive Care for the Elderly (PACE) (Eng et al. 1997; Greenwood 2001; Gross et al. 2004). This study shows how these tradeoffs can be systematically modeled to support system-level decision-making around access to these programs.

The long-term decline in mental health inpatient utilization also suggests that a further re-assessment of the cost-effectiveness of the traditional ACT model compared with alternative service delivery models would be useful. Researchers have for some time questioned the efficiency of providing ACT services indefinitely at the high level of intensity stipulated within the ACT model (Sherman and Ryan 1998) and have suggested placing time limits on participation or transitioning stable clients to a less intensive case management model. From an economic perspective, declining savings from ACT services makes such a modification more attractive. Whether such modifications make sense from a clinical or systems management perspective requires examination. However, time-limited case management service models such as the "critical time intervention" (Susser et al. 1997; Herman et al. 2000, 2011; Jones et al. 2003) appear to be useful complements to ACT, at least for some ACT clients.

VA mental health care services differ from most states' public mental health systems, and these differences may affect the interpretation and generalizability of our findings. First, although VA ACT programs remain congruent with the essential principles of the ACT model, in that they are similar in terms of staff–patient ratios, staff composition, mobile service delivery, and frequency of contact with patients, the VA ACT model represents an adaptation of the ACT model to the VA health care system. A key difference is that VA ACT teams operate within an integrated health care environment, whereas in public systems of care, ACT teams usually operate in a diffuse, non-integrated service environment. As a result, VA ACT teams may not directly provide some services needed by their clients, such as substance abuse treatment, and may instead facilitate client access to a VA substance abuse treatment group. In addition, few teams offer services 24 hours a day, as VA patients have 24–7 access to crisis services at VA hospitals. At the patient level, these differences could result in more frequent failures to coordinate services for VA ACT patients. Such failures could result in unnecessary or duplicative use of other intensive outpatient services (e.g., partial hospitalization) and greater health care costs. In non-VA programs, care coordination issues may be less important because the ACT team is likely to be the only publicly authorized provider of services for an ACT client. Second, the VA's mental health system allows for longer inpatient mental health stays than in many public mental health systems (Greenberg and Rosenheck 2010), and patients have access to VA housing supports. Consequently, compared with non-VA ACT programs, VA ACT programs could have greater impacts on inpatient days and produce greater savings. Third, although ~90 percent of VA ACT clients have either a schizophrenia or a bipolar disorder diagnosis (Neale et al. 2009), other diagnoses may be more common in non-VA ACT programs. Given the strong relationship that exists between psychosis and recurrent need for hospitalization, our estimates of the effects of VA ACT programs on inpatient utilization and costs may generalize only to persons with psychotic disorders.

It is also notable that the instrumental variables estimation approach (Angrist, Imbens, and Rubin 1996; Heckman 1996; Hogan and Lancaster 2004) resulted in generally larger impacts of ACT enrollment than were obtained using only propensity score estimation (Rosenbaum and Rubin 1983; Ho et al. 2007). Propensity score matching alone, based on observed covariates, may have resulted in underestimation of the impacts of VA ACT enrollment on mental health inpatient use and costs, because it may not have fully adjusted for the greater illness severity and complexity of VA ACT clients compared with VA patients who met certain eligibility criteria for ACT services but did not enroll.

In the current era of fiscal stringency, state and federal policy makers are likely to be reviewing all mental health care costs. However, in most public mental health systems, expenditures on inpatient care have already been reduced to the point that further inpatient savings are difficult to achieve. Expensive outpatient programs such as ACT services are another potential target for budget cuts. The results of this study indicate that a strong cost-effectiveness argument can still be made for appropriately targeted ACT services. However, as the major rationale for ACT services has been attenuated, further adaptation of the ACT model and better integration of ACT with complementary services and programs could result in a more cost-effective allocation of limited public mental health budgets.

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